Global Dental Education

Current Cariology Education in Dental Schools in Spanish-Speaking Latin American Countries


Abstract: This study sought to provide an overview of current cariology education in Spanish-speaking Latin American dental schools. Data collection was via an eighteen-item survey with questions about curriculum, methods of diagnosis and treatment, and instructors’ perceptions about cariology teaching. The response rate was 62.1 percent (n=54), and distribution of participating schools by country was as follows: Bolivia (four), Chile (four), Colombia (twenty-four), Costa Rica (one), Cuba (one), Dominican Republic (two), El Salvador (two), Mexico (six), Panama (two), Peru (four), Puerto Rico (one), Uruguay (two), and Venezuela (one). Forty percent of the responding schools considered cariology the key axis of a course, with a cariology department in 16.7 percent. All schools reported teaching cariology, but with varying hours and at varying times in the curriculum, and 77.8 percent reported having preclinical practices. The majority reported teaching most main teaching topics, except for behavioral sciences, microbiology, saliva and systemic diseases, caries-risk factors, root caries, erosion, and early caries management strategies. The most frequently taught caries detection methods were visual-tactile (96.3 percent), radiographic (92.6 percent), and the International Caries Detection and Assessment System (ICDAS) (61.1 percent). Respondents said their schools’ clinics make an operative treatment decision when radiolucency is in the inner half of enamel (42.3 percent) for radiographic criteria and when the lesion is visually non-cavitated (5.8 percent). All respondents reported that their schools teach preventive strategies, but only 43.4 percent said they tie it to risk assessment and 40.7 percent said they implement nonsurgical management regularly.

Dr. Martignon is Associate Professor, Caries Research Unit UNICA, Dental Faculty, Universidad El Bosque, Bogotá, Colombia; Ms. Gomez is Associate Instructor, Caries Research Unit UNICA, Dental Faculty, Universidad El Bosque, Bogotá, Colombia; Dr. Tellez is Associate Professor, Maurice H. Kornberg School of Dentistry, Temple University, Philadelphia, PA, USA; Jaime Ruiz is Professor, Caries Research Unit UNICA, Dental Faculty, Universidad El Bosque, Bogotá, Colombia; Lina Marin is Assistant Instructor, Caries Research Unit UNICA, Dental Faculty, Universidad El Bosque, Bogotá, Colombia; and Ms. Rangel is Dean, Dental Faculty, Universidad El Bosque, Av. Cra 9 No. 131A-02, Bogotá, Colombia. Direct correspondence and requests for reprints to Dr. Stefania Martignon, Caries Research Unit UNICA, Dental Faculty, Universidad El Bosque, Av. Cra 9 No. 131A-02, Bogotá, Colombia; martignonstefania@unbosque.edu.co.

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The modern understanding of caries has shifted from the traditional concept of caries being only an endpoint—a cavity—towards the caries process itself, especially since there is evidence that the caries process can be arrested, mainly in its first manifestations. These changes have had at least three consequences in the conception of caries and the clinical diagnosis process: 1) there are different degrees of caries severity, involving enamel and dentin lesions; 2) visual examination has become more reliable for caries detection and assessment; and 3) caries management is no longer considered to rely solely on operative treatment but includes non-operative strategies, so that treatment decisions should be made according to a comprehensive synthesis of diagnosis at both tooth/surface and patient levels. As a result, the clinical, epidemiological, research, and educational implications of caries management need to be considered.

Even though the prevalence of caries has declined worldwide, in developing countries such as those in Latin America, caries continues to be a public health problem associated with barriers to health care access and economic, educational, and social inequalities. The responsibility for development of appropriate oral health care as the basis for clinical decision making should be with the dental schools, and education of future practitioners must follow an evidence-based curriculum. Like dental schools in North American and European countries...
that share interests in national and international organizations, Spanish-speaking Latin American and Caribbean dental schools have become members of the Organization of Dental Faculties, Schools, and Departments—Latin American and Caribbean Universities Union (Organización de Facultades, Escuelas y Departamentos de Odontología—Unión de Universidades de América Latina y el Caribe, OFEDO-UDUAL), an institution that seeks to promote student and faculty academic exchange and curricular concerns across dental schools. To contribute to this international understanding of oral health issues, the aim of our study was to assess cariology education for undergraduate students in Spanish-speaking Latin American dental schools.

Methods

A cross-sectional study of Spanish-speaking Latin American dental schools was conducted from 2009 to 2011. We designed a thirty-item questionnaire about cariology education based on questions from the following sources: surveys conducted by Clark and Mjör, a survey administered by the American Dental Education Association’s Section on Cariology, a chapter by Kidd and Fejerskov in their cariology textbook, discussions from International Caries Detection and Assessment System (ICDAS) annual meetings, and concepts discussed by the authors. The questions aimed to assess four main areas: curriculum, diagnosis, treatment, and perceptions about how the teaching of cariology is being incorporated into the respondent’s school. This study was considered exempt by the Universidad El Bosque Institutional Review Board.

The initial questionnaire was validated in terms of content in 2009, by assessing the understanding of the questions’ meaning, content, and language. Five cariology teachers from Universidad El Bosque conducted the first assessment. Their suggestions led us to reduce the questionnaire to twenty-three items. The second assessment was conducted with the help of two focus groups of twenty faculty members each: one was conducted in Bogotá, Colombia, with members of the Colombian Association of Dental Schools (Asociación Colombiana de Facultades de Odontología, ACFO); and one was conducted at the International Association for Dental Research (IADR) Latin American Annual Congress in Isla Margarita, Venezuela. These focus groups followed an assessment guideline. The moderator explained the purpose of the study and asked the participants to read the questionnaire, after which discussion was held. The focus group sessions were audio-recorded, and a reporter took notes. The analyses of these transcriptions searched for coincident and non-coincident points and led to modifications of questions and answer options. The Latin American focus group led also to Spanish language adaptations. The final questionnaire consisted of eighteen questions (seven close-ended multiple-choice, six scaled, four close-ended dichotomous, and one open-ended). The number of questions administered by dimensions evaluated was as follows: curriculum (seven), diagnosis (five), treatment (five), and perceptions (one).

The sample for the study was obtained by convenience. Eighty-seven dental schools were invited to participate, including all schools associated with OFEDO-UDUAL (n=54), all schools associated with ACFO (n=24), and other schools from the Universidad El Bosque database (n=21). Some schools were members of more than one of these groups. The number of dental schools invited to participate from the following countries was as follows: Argentina (one), Bolivia (four), Chile (four), Colombia (twenty-four), Costa Rica (one), Cuba (one), Dominican Republic (four), Ecuador (three), El Salvador (two), Honduras (one), Mexico (twenty-seven), Panama (two), Peru (four), Puerto Rico (one), Uruguay (two), and Venezuela (six).

The dental schools’ deans/chairs were sent a letter of invitation for their school to participate in the study, including a brief description of the project. They were asked to provide the name and contact information of the primary cariology faculty members at their school. Those faculty members were then invited to participate and were instructed to complete the survey either online using the platform Moodle (Module Object-Oriented Dynamic Learning Environment) from the Universidad El Bosque or in a Word document to be returned by e-mail. Three reminders were sent to invited faculty members and the schools’ deans/chairs via e-mail. Data from the questionnaires were transferred to an Excel (Microsoft Office, 2010) database, and consistency checking was done to minimize the possibility of errors. Descriptive analyses were conducted exploring frequency distributions of categorical variables and mean/SD of continuous variables with the Epi Info software.

Results

A total of fifty-four questionnaires were completed out of the eighty-seven sent, for a response
rate of 62.1 percent. The distribution of responding schools by country was as follows: Bolivia (four), Chile (four), Colombia (twenty-four), Costa Rica (one), Cuba (one), Dominican Republic (two), El Salvador (two), Mexico (six), Panama (two), Peru (four), Puerto Rico (one), Uruguay (two), and Venezuela (one).

**Curriculum Questions**

To Question 1 (“Is cariology teaching at your school the axis or part of a course?”), cariology was reported to be the key axis of a course in fewer than half of the responding schools (42.3 percent). Two schools (3.7 percent) did not answer this question. To Question 2 (“Which department teaches cariology at your school?”), there was an independent Department of Cariology in charge of teaching cariology in 16.7 percent of the schools. The next most frequently named departments that teach cariology were the Department of Operative/Restorative Dentistry (14.8 percent) and Department of Pediatric Dentistry (11.1 percent). In 9.3 percent of the schools, two departments were in charge, and in almost one-fourth (24.0 percent) there was a combination of more than two departments (Figure 1). To Question 3 (“Which caries textbook is recommended for cariology teaching at your school?”), more than one textbook was recommended for the majority of responding schools (70.4 percent). The textbooks most often used were Thystrup and Fejerskov (27.8 percent), Fejerskov and Kidd (27.8 percent), Henostroza (18.6 percent), Seif (18.6 percent), and two cariology clinical management guidelines edited in Colombia: González et al. (15.2 percent) and Martignon et al. (15.2 percent). Other textbooks used in five or fewer schools were two published in English (Axelsson and Kidd) and four published in Spanish (Cárdenas, Barrancos, Moncada and Urzúa, and Silverstone).

To Question 4 (“In which year/s do students have theoretical cariology teaching?”), 27.8 percent of responding schools said it was in the second year, followed by a combination of teaching in the second and third years (18.5 percent) and only in the third year (14.8 percent). Of the responding schools, 24.1 percent reported starting cariology teaching in the first year, with 9.3 percent starting in the second year and 5.6 percent in the third year. To Question 5 (“How..."
many hours per week are the students being taught about cariology?”), more than half of these schools (53.7 percent) reported devoting two weekly hours to the teaching of cariology, with 37.0 percent reporting between three and seven hours and 9.3 percent more than seven hours. Regarding the request in Question 6 to indicate the topic/s being taught in the respondent’s curriculum, Table 1 shows the percentage of schools teaching each subject. To Question 7 (“Do your students have preclinical practice workshops about theoretical concepts before their first contact with patients?”), most schools (77.8 percent) said students participate in preclinical practice workshops before having contact with patients.

**Diagnosis Questions**

Concerning caries detection methods (Question 8: “Which caries detection method/s is/are being taught at your school?”), more than nine out of ten said they teach visual/tactile techniques (96.3 percent) and radiographic interpretation (92.6 percent). Large percentages also reported teaching DMF (72.2 percent), the ICDAS system (61.1 percent), and activity assessment of caries lesions (64.8 percent). Other methods mentioned were magnification (25.9 percent) and fluorescence-based methods (14.8 percent). To Question 9 (“If caries risk assessment is taught in your school, please indicate which risk factors are considered”), only one dental school (1.9 percent) reported not incorporating caries risk assessment into the curriculum. Table 2 shows the percentage of schools teaching each subject.

To Question 10 (“When do patients have bite-wing radiographs taken?”), the most common reason reported was to confirm visual/tactile diagnosis (61.1 percent), followed by the patient being considered at a high risk for caries (51.8 percent), diagnosis on a regular basis (50.0 percent), for monitoring purposes (44.4 percent), and for diagnostic purposes in a recall after five years (35.2 percent). Two schools (3.8 percent) did not answer Question 11: “From what radiolucency depth (caries severity stage) of the lesion does your school indicate operative treatment?” Over 40 percent of the schools (42.3 percent) reported making an operative treatment decision when the radiolucency is present in the inner enamel half up to the enamel-dentinal junction (EDJ) (Figure 2). One school (1.9 percent) did not answer Question 12: “At which clinical visual/tactile severity stage of the lesion does your school indicate operative treatment?” Of the responding schools, 5.8 percent reported making an operative treatment decision when the visual assessment detects a non-cavitated lesion and 37.7 percent when it corresponds to a micro-cavity/enamel breakdown (Figure 3).

**Treatment Questions**

Question 13 asked: “If early caries management (caries prevention, arrestment, remineralization) is taught in your school, please indicate which topics are considered.” Table 3 shows the percentage of schools teaching each topic. To Question 14 (“How
Figure 2. Radiographic operative treatment decision thresholds at responding dental schools (n=54)

Figure 3. Visual-tactile operative treatment decision thresholds at responding dental schools (n=54)
often does the risk assessment drive caries management in the clinical practice of your school?”), almost half of the responding schools (49.1 percent) answered occasionally, 43.4 percent regularly, and 7.5 percent never. One dental school said it does not incorporate caries risk assessment (1.9 percent). To Question 15 (“In which way is oral health education communicated to patients being treated at your school clinic?”), 63.0 percent of the responding schools said that most patients receive specific individual oral health education, while patients at 33.3 percent of these schools receive only collective oral health education and 3.7 percent receive a combination of both.

To Question 16 (“How often are non-operative caries management strategies being implemented at your school clinic?”), more than half of the responding schools (51.9 percent) said they occasionally implement non-operative caries management strategies; 40.7 percent said they do so on a regular basis and 7.4 percent never. One school (1.9 percent) did not answer Question 17: “Does your school teach how to repair/reseal restorations as alternatives to operative treatment?” Of the responding schools, most (71.7 percent) reported teaching how to repair/reseal restorations as alternatives to operative treatment.

Perceptions

Finally, Question 18 asked: “Do you believe cariology is being taken into account in an appropriate way within your school curriculum?” Almost two-thirds of the responding schools (63.0 percent) said they consider that cariology is not being taken into account in an appropriate way in their curriculum and would favor the development of a cariology curriculum.

Discussion

At a time when the paradigm shift in cariology has led to conceptual and practical changes worldwide, ours is the first survey to assess the teaching of cariology in Spanish-speaking Latin American countries. A study in Europe recently resulted in a similar report,29 and a study in the United States has also been conducted.13 This trend is leading to the restructuring of cariology in the curriculum for undergraduate dental students, with the first proposal coming from Europe.30

Our study faced an inherent limitation because there is uncertainty about the existing universe of dental schools in Spanish-speaking Latin American countries: there are no reliable databases and the number of private schools has grown considerably in the last years. The Latin American Dental Federation (FOLA-FDI)31 reports 119 dental schools in the eighteen Spanish-speaking associated countries, excluding Puerto Rico, but with no data for Mexico and Colombia and without contact information. OFEDO/UDUAL, the Latin American dental schools association, had fifty-four associated dental schools in 2009.11 We were able to contact the deans in twenty-two additional Spanish-speaking Latin American dental schools and in the twenty-four schools in Colombia associated with the ACFO, seven of which were OFEDO/UDUAL members as well. In total, we secured complete contact data for eighty-seven dental schools in Latin America, which corresponds to the sample size; these included sixteen of the nineteen Spanish-speaking countries.

Our efforts to contact the largest number of schools and countries possible and the multiple reminders sent resulted in a response rate of 62.1 percent. This level is similar to that in the study conducted by Clark and Mjör12 in North America (66 percent) in 2001 but low when compared to the study conducted in Europe by Schulte et al.29 (72 percent) and to a recent study in the United States by Fontana et al.13 (83 percent). Our response rate reflects the inherent difficulties of conducting studies of this nature. As contact with Colombian schools was easier for us, all of them responded (n=24), accounting for 44.4 percent of the total respondents.

The continuing influence of the surgical approach to caries can be seen across these schools. Although the respondents from most of these schools (63.0 percent) reported a perception that cariology

<table>
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<tr>
<th>Early Caries Management Topics</th>
<th>Percentage of Respondents</th>
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<tr>
<td>Professional plaque removal</td>
<td>96.3%</td>
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<tr>
<td>Oral hygiene instructions</td>
<td>94.4%</td>
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<tr>
<td>Cariogenic diet management</td>
<td>85.2%</td>
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<tr>
<td>Fluoride</td>
<td>92.6%</td>
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<tr>
<td>Management of hyposalivation</td>
<td>61.1%</td>
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<tr>
<td>Dental sealants</td>
<td>92.6%</td>
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<tr>
<td>Calcium-based strategies</td>
<td>27.6%</td>
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<tr>
<td>Xylitol-based strategies</td>
<td>38.8%</td>
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<tr>
<td>Antibacterial strategies</td>
<td>74.0%</td>
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<tr>
<td>pH neutralization strategies</td>
<td>53.7%</td>
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is not being properly addressed in their school’s curriculum, all of them include it in their teaching competences (42.3 percent as an axis course). This demonstrates cariology is considered a key component of undergraduate dental education across Spanish-speaking Latin America and is consistent with the findings from Europe. Our findings along with the great variation in answers regarding curriculum aspects (questions 1-5) support the idea that common cariology competences should be developed for Spanish-speaking Latin American countries. The wide number of cariology textbooks recommended and the inclusion of caries management guidelines as textbooks reflect the changing paradigm process but also the need for writing and publishing modern textbooks in Spanish.

As in the research in Europe, our study found broad consensus about the majority of the fifteen main areas that should be taught, with 100 percent agreement in nine areas. Main areas with less agreement were behavioral sciences (51.8 percent) and caries management in populations and dental erosion (both with 64.8 percent). There was around 80 percent agreement regarding root caries, caries risk assessment, and caries epidemiological description/analysis. The same trend was observed for the main teaching areas regarding caries risk, but with less consensus on factors related to systemic diseases, saliva, microorganisms, and lifestyle/self-care. Early caries management, hyposalivation management, and use of modern remineralizing agents were considered the most lacking teaching aspects. The lower agreement regarding these aspects reflects gaps in the knowledge base for cariology teaching according to Schulte et al. The same observation applies to less consensus on dental education in public health, management of caries according to risk, management of caries in elderly patients, and non-curious wear.

Not all the schools in our study reported having their students participate in preclinical practice workshops (77.8 percent), and attention to the transference of theoretical concepts to clinical practice seems to be even lower (48 percent). These varying attitudes may reflect the existing mixture of paradigms discussed by Fejerskov. Concerning the detection and assessment of dental caries in the clinic, bitewing radiographs were not being taken on a regular basis for diagnostic purposes in the schools in our study even though nearly all reported teaching the use of radiography (92.6 percent) and most Latin American countries are regarded as high-caries risk populations. Just over 60 percent of the schools (61.1 percent) reported using a caries system that includes non-cavitated lesions, namely ICDAS; nevertheless, 5.8 percent of the schools reported their clinics make operative treatment decisions when the visual appearance of the lesion corresponds to a brown/white spot lesion and 42.3 percent of them when the radiographic appearance of the lesion shows a radiolucency in the inner half of the enamel. These clinical practices reflect a lack of adherence to the current caries paradigm. Furthermore, the fact that 37.7 percent of these schools’ clinics treat operatively when the lesion is visually assessed as a micro-cavity is also related to the traditional manner of treating caries. This practice seems to be persisting although it is now known that these types of lesions are regarded as needing a more comprehensive individual lesion assessment (radiographic detection to assess the depth of the radiolucency more accurately); depending on this and the individual caries risk in many lesions, a non-invasive treatment could be provided. Our study suggests that non-operative caries management strategies are not being implemented on a regular basis across these schools, although they should be encouraged based on the theoretical teaching of cariology.

The respondents in our study agreed about the difficulty of developing standardized concepts among faculty members from different areas/departments such as microbiology, pediatric dentistry, and operative/restorative dentistry although the resulting inconsistencies make it more difficult for students in clinical practice. The need to develop standardized treatment principles is also hindered by the wide range of areas/departments responsible for caries education and by generational differences among faculty members. These challenges continue to delay universal acceptance of the paradigm shift in caries, as Fejerskov discussed in his key article published in 2004.

**Conclusion**

Even with the sample limitations of our study, the results give the picture of a mixture of very modern concepts with some more traditional ones regarding cariology education in Spanish-speaking Latin American dental schools, but the wide interest reported in expanding the teaching of dental caries for undergraduate dental students was notable. In Colombia, our results have helped stimulate the development of a nation-wide consensus among the twenty-four ACFO dental schools regarding cariol-
ogy education for undergraduate students, following the first goal of the Alliance for a Cavity-Free Future (ACFF) of the Colombian Chapter. Other countries such as Brazil, Mexico, and Venezuela and organizations such as OFEDO/UDUAL are beginning to move in these directions as well. Future research on this topic should include a broader sample and should also assess cariology research, continuing education, and public health; conducting qualitative analyses in these areas would also be useful.

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REFERENCES